CLAIMS

What is claimed is:

1. A method for a network element to support a protected communication link in a communication network, the method comprises the steps of:

receiving a link command to establish a communication link, wherein the link command includes link protection criteria;

determining whether the network element is a termination node of the communication link;

when the network element is not a termination node of the communication link, determining an optimal path for the communication link via a plurality of network elements of the communication network based on the link protection criteria;

determining type of path to an adjacent one of the plurality of network elements based on link coupling protocol of coupling to the adjacent one of the plurality of network elements; and

processing the link command based on the type of path to the adjacent one of the plurality of network elements.

2. The method of claim 1, wherein the processing the link command further comprises:

when the link coupling protocol is UPSR, determining support needed for the communication link;

when the supported needed is to add a connection, determining type of protection based on the link protection criteria;

when the type of protection is unprotected/preemptable:

identifying a protect ring having a working path and a back-up path;

assigning resources with respect to the adjacent one of the plurality of network elements in the back-up path;

generating a network element link command to establish the communication link as an unprotected/preemptable link in the back-up path; and

providing the network element link command to the adjacent one of the plurality of network elements.

3. The method of claim 2 further comprises:

when the type of protection is unprotected/non-preemptable:

creating a protect ring having a first working path and a second working path;

assigning resources with respect to the adjacent one of the plurality of network elements in the first working path;

generating a network element link command to establish the communication link as an unprotected/non-preemptable link in the first working path; and

providing the network element link command to the adjacent one of the plurality of network elements.

4. The method of claim 2 further comprises:

when the type of protection is unprotected/non-preemptable:

identifying a protect ring having a first working path and a second working path, wherein the second working path is available;

assigning resources with respect to the adjacent one of the plurality of network elements in the second working path;

generating a network element link command to establish the communication link as an unprotected/non-preemptable link in the second working path; and

providing the network element link command to the adjacent one of the plurality of network elements.

5. The method of claim 1, wherein the processing the link command further comprises:

when the link coupling protocol is BLSR, determining support needed for the communication link;

when the supported needed is to add a connection, determining type of protection based on the link protection criteria;

when the type of protection is unprotected/preemptable:

identifying a protect ring having a working path and a back-up path;

assigning resources with respect to each network element in the back-up path;

generating a network element link command to establish the communication link as an unprotected/preemptable link; and

providing the network element link command to the adjacent one of the plurality of network elements that is adjacent to the protect ring.

6. The method of claim 5 further comprises:

when the type of protection is unprotected/non-preemptable:

creating a protect ring having a first working path and a second working path;

assigning resources with respect to each network element in the first working path;

generating a network element link command to establish the communication link as an unprotected/non-preemptable link in the first working path; and

providing the network element link command to the adjacent one of the plurality of network elements that is adjacent to the protect ring.

7. The method of claim 5 further comprises:

when the type of protection is unprotected/non-preemptable:

identifying a protect ring having a first working path and a second working path, wherein the second working path is available;

assigning resources with respect to each network element in the second working path;

generating a network element link command to establish the communication link as an unprotected/non-preemptable link in the second working path; and

providing the network element link command to the adjacent one of the plurality of network elements that is adjacent to the protect ring.

8. The method of claim 1, wherein the processing the link command further comprises:

when the link coupling protocol is linear, determining type of protection based on the link protection criteria;

when the type of protection is one-to-one protection:

assigning first resources with respect to the adjacent one of the plurality of network elements;

assigning second resources with respect to the adjacent one of the plurality of network elements;

generating a network element link command to establish the communication link as an protected link; and

providing the network element link command to the adjacent one of the plurality of network elements.

9. A method for a network element to support a protected communication link in a communication network, the method comprises the steps of:

receiving a link command that includes link protection criteria;

determining whether the link command is a network manager link command or a network element link command, wherein the link command identifies at least one of a first port and a second port of the communication link;

when the link command is a network manager link command:

determining type of the link command;

when the type of the link command is an establish a connection command:

determining an optimal path for the communication link via a plurality of network elements of the communication network in accordance with the link protection criteria;

determining type of path to an adjacent one of the plurality of network elements based on link coupling protocol of coupling to the adjacent one of the plurality of network elements; and

processing the link command based on the type of path to the adjacent one of the plurality of network elements.

10. The method of claim 9 further comprises:

when the link command is a network element link command, determining type of the link command;

when the type of the link command is an establish a connection command, determining whether the network element is a termination node of the communication link;

when the network element is not a termination node of the communication link:

determining an optimal path for the communication link via a plurality of network elements of the communication network based on the link protection criteria;

determining type of path to an adjacent one of the plurality of network elements based on link coupling protocol of coupling to the adjacent one of the plurality of network elements; and

processing the link command based on the type of path to the adjacent one of the plurality of network elements.

11. The method of claim 9, wherein the processing the link command further comprises:

when the link coupling protocol is UPSR, determining support needed for the communication link;

when the supported needed is to add a connection, determining type of protection based on the link protection criteria;

when the type of protection is unprotected/preemptable:

identifying a protect ring having a working path and a back-up path;

assigning resources with respect to the adjacent one of the plurality of network elements in the back-up path;

generating a network element link command to establish the communication link as an unprotected/preemptable link in the back-up path; and

providing the network element link command to the adjacent one of the plurality of network elements.

12. The method of claim 11 further comprises:

when the type of protection is unprotected/non-preemptable:

creating a protect ring having a first working path and a second working path;

assigning resources with respect to the adjacent one of the plurality of network elements in the first working path;

generating a network element link command to establish the communication link as an unprotected/non-preemptable link in the first working path; and

providing the network element link command to the adjacent one of the plurality of network elements.

13. The method of claim 11 further comprises:

when the type of protection is unprotected/non-preemptable:

identifying a protect ring having a first working path and a second working path, wherein the second working path is available;

assigning resources with respect to the adjacent one of the plurality of network elements in the second working path;

generating a network element link command to establish the communication link as an unprotected/non-preemptable link in the second working path; and

providing the network element link command to the adjacent one of the plurality of network elements.

14. The method of claim 9, wherein the processing the link command further comprises:

when the link coupling protocol is BLSR, determining support needed for the communication link;

when the supported needed is to add a connection, determining type of protection based on the link protection criteria;

when the type of protection is unprotected/preemptable:

identifying a protect ring having a working path and a back-up path;

assigning resources with respect to each network element in the back-up path;

generating a network element link command to establish the communication link as an unprotected/preemptable link; and

providing the network element link command to the adjacent one of the plurality of network elements that is adjacent to the protect ring.

15. The method of claim 14 further comprises:

when the type of protection is unprotected/non-preemptable:

creating a protect ring having a first working path and a second working path;

assigning resources with respect to each network element in the first working path;

generating a network element link command to establish the communication link as an unprotected/non-preemptable link in the first working path; and

providing the network element link command to the adjacent one of the plurality of network elements that is adjacent to the protect ring.

16. The method of claim 14 further comprises:

when the type of protection is unprotected/non-preemptable:

identifying a protect ring having a first working path and a second working path, wherein the second working path is available;

assigning resources with respect to each network element in the second working path;

generating a network element link command to establish the communication link as an unprotected/non-preemptable link in the second working path; and

providing the network element link command to the adjacent one of the plurality of network elements that is adjacent to the protect ring.

17. The method of claim 9, wherein the processing the link command further comprises:

when the link coupling protocol is linear, determining type of protection based on the link protection criteria;

when the type of protection is one-to-one protection:

assigning first resources with respect to the adjacent one of the plurality of network elements;

assigning second resources with respect to the adjacent one of the plurality of network elements;

generating a network element link command to establish the communication link as an protected link; and

providing the network element link command to the adjacent one of the plurality of network elements.

18. A network element for using in a communication system, the network element comprises:

processing module; and

memory operably coupled to the processing module, wherein the memory includes operational instructions to:

receive a link command that includes link protection criteria;

determine type of the link command;

when the type of the link command is an establish a connection command, determine whether the network element is a termination node of the communication link;

when the network element is not a termination node of the communication link, determine an optimal path for the communication link via a plurality of network elements of the communication network based on the link protection criteria;

determine type of path to an adjacent one of the plurality of network elements based on link coupling protocol of coupling to the adjacent one of the plurality of network elements; and

process the link command based on the type of path to the adjacent one of the plurality of network elements.

19. The network element of claim 18, wherein the memory further comprises operational instructions that cause the processing module to process the link command by:

when the link coupling protocol is UPSR, determining support needed for the communication link;

when the supported needed is to add a connection, determining type of protection based on the link protection criteria;

when the type of protection is unprotected/preemptable:

identifying a protect ring having a working path and a back-up path;

assigning resources with respect to the adjacent one of the plurality of network elements in the back-up path;

generating a network element link command to establish the communication link as an unprotected/preemptable link in the back-up path; and

providing the network element link command to the adjacent one of the plurality of network elements.

20. The network element of claim 19, wherein the memory further comprises operational instructions that cause the processing module to:

when the type of protection is unprotected/non-preemptable:

create a protect ring having a first working path and a second working path;

assign resources with respect to the adjacent one of the plurality of network elements in the first working path;

generate a network element link command to establish the communication link as an unprotected/non-preemptable link in the first working path; and

provide the network element link command to the adjacent one of the plurality of network elements.

21. The network element of claim 19, wherein the memory further comprises operational instructions that cause the processing module to:

when the type of protection is unprotected/non-preemptable:

identify a protect ring having a first working path and a second working path, wherein the second working path is available;

assign resources with respect to the adjacent one of the plurality of network elements in the second working path;

generate a network element link command to establish the communication link as an unprotected/non-preemptable link in the second working path; and

provide the network element link command to the adjacent one of the plurality of network elements.

22. The network element of claim 18, wherein the memory further comprises operational instructions that cause the processing module to process the link command by:

when the link coupling protocol is BLSR, determine support needed for the communication link;

when the supported needed is to add a connection, determine type of protection based on the link protection criteria;

when the type of protection is unprotected/preemptable:

identify a protect ring having a working path and a back-up path;

assign resources with respect to each network element in the back-up path;

generate a network element link command to establish the communication link as an unprotected/preemptable link; and

provide the network element link command to the adjacent one of the plurality of network elements that is adjacent to the protect ring.

23. The network element of claim 22, wherein the memory further comprises operational instructions that cause the processing module to:

when the type of protection is unprotected/non-preemptable:

create a protect ring having a first working path and a second working path;

assign resources with respect to each network element in the first working path;

generate a network element link command to establish the communication link as an unprotected/non-preemptable link in the first working path; and

provide the network element link command to the adjacent one of the plurality of network elements that is adjacent to the protect ring.

24. The network element of claim 22, wherein the memory further comprises operational instructions that cause the processing module to:

when the type of protection is unprotected/non-preemptable:

identify a protect ring having a first working path and a second working path, wherein the second working path is available;

assign resources with respect to each network element in the second working path;

generate a network element link command to establish the communication link as an unprotected/non-preemptable link in the second working path; and

provide the network element link command to the adjacent one of the plurality of network elements that is adjacent to the protect ring.

25. The network element of claim 18, wherein the memory further comprises operational instructions that cause the processing module to process the link command by:

when the link coupling protocol is linear, determining type of protection based on the link protection criteria;

when the type of protection is one-to-one protection:

assigning first resources with respect to the adjacent one of the plurality of network elements;

assigning second resources with respect to the adjacent one of the plurality of network elements;

generating a network element link command to establish the communication link as an protected link; and

providing the network element link command to the adjacent one of the plurality of network elements.

26. A network element for using in a communication system, the network element comprises:

processing module; and

memory operably coupled to the processing module, wherein the memory includes operational instructions to:

receive a link command that includes link protection criteria;

determine whether the link command is a network manager link command or a network element link command, wherein the link command identifies at least one of a first port and a second port of the communication link;

when the link command is a network manager link command:

determine type of the link command;

when the type of the link command is an establish a connection command:

determine an optimal path for the communication link via a plurality of network elements of the communication network in accordance with the link protection criteria;

determine type of path to an adjacent one of the plurality of network elements based on link coupling protocol of coupling to the adjacent one of the plurality of network elements; and

process the link command based on the type of path to the adjacent one of the plurality of network elements.

27. The network element of claim 26, wherein the memory further comprises operational instructions that cause the processing module to:

when the link command is a network element link command, determine type of the link command;

when the type of the link command is an establish a connection command, determine whether the network element is a termination node of the communication link;

when the network element is not a termination node of the communication link:

determine an optimal path for the communication link via a plurality of network elements of the communication network based on the link protection criteria;

determine type of path to an adjacent one of the plurality of network elements based on link coupling protocol of coupling to the adjacent one of the plurality of network elements; and

process the link command based on the type of path to the adjacent one of the plurality of network elements.

28. The network element of claim 26, wherein the memory further comprises operational instructions that cause the processing module to process the link command by:

when the link coupling protocol is UPSR, determining support needed for the communication link;

when the supported needed is to add a connection, determining type of protection based on the link protection criteria;

when the type of protection is unprotected/preemptable:

identifying a protect ring having a working path and a back-up path;

assigning resources with respect to the adjacent one of the plurality of network elements in the back-up path;

generating a network element link command to establish the communication link as an unprotected/preemptable link in the back-up path; and

providing the network element link command to the adjacent one of the plurality of network elements.

29. The network element of claim 28, wherein the memory further comprises operational instructions that cause the processing module to:

when the type of protection is unprotected/non-preemptable:

create a protect ring having a first working path and a second working path;

assign resources with respect to the adjacent one of the plurality of network elements in the first working path;

generate a network element link command to establish the communication link as an unprotected/non-preemptable link in the first working path; and

provide the network element link command to the adjacent one of the plurality of network elements.

30. The network element of claim 28, wherein the memory further comprises operational instructions that cause the processing module to:

when the type of protection is unprotected/non-preemptable:

identify a protect ring having a first working path and a second working path, wherein the second working path is available;

assign resources with respect to the adjacent one of the plurality of network elements in the second working path;

generate a network element link command to establish the communication link as an unprotected/non-preemptable link in the second working path; and

provide the network element link command to the adjacent one of the plurality of network elements.

31. The network element of claim 26, wherein the memory further comprises operational instructions that cause the processing module to:

when the link coupling protocol is BLSR, determine support needed for the communication link;

when the supported needed is to add a connection, determine type of protection based on the link protection criteria;

when the type of protection is unprotected/preemptable:

identify a protect ring having a working path and a back-up path;

assign resources with respect to each network element in the back-up path;

generate a network element link command to establish the communication link as an unprotected/preemptable link; and

provide the network element link command to the adjacent one of the plurality of network elements that is adjacent to the protect ring.

32. The network element of claim 31, wherein the memory further comprises operational instructions that cause the processing module to:

when the type of protection is unprotected/non-preemptable:

create a protect ring having a first working path and a second working path;

assign resources with respect to each network element in the first working path;

generate a network element link command to establish the communication link as an unprotected/non-preemptable link in the first working path; and

provide the network element link command to the adjacent one of the plurality of network elements that is adjacent to the protect ring.

33. The network element of claim 31, wherein the memory further comprises operational instructions that cause the processing module to:

when the type of protection is unprotected/non-preemptable:

identify a protect ring having a first working path and a second working path, wherein the second working path is available;

assign resources with respect to each network element in the second working path;

generate a network element link command to establish the communication link as an unprotected/non-preemptable link in the second working path; and

provide the network element link command to the adjacent one of the plurality of network elements that is adjacent to the protect ring.

34. The network element of claim 26, wherein the memory further comprises operational instructions that cause the processing module to process the link command by:

when the link coupling protocol is linear, determining type of protection based on the link protection criteria;

when the type of protection is one-to-one protection:

assigning first resources with respect to the adjacent one of the plurality of network elements;

assigning second resources with respect to the adjacent one of the plurality of network elements;

generating a network element link command to establish the communication link as an protected link; and

providing the network element link command to the adjacent one of the plurality of network elements.